the west end of the strip. The Skid Strip is classified as a Class B runway; both visual flight rules (VFR) and instrument flight rules (IFR) are supported. Air traffic is controlled from PAFB (26 km (16 mi) to the south). Aircraft operations on CCAS are limited to transport planes delivering missiles, spacecraft, or associated components. Occasionally, the Skid Strip has been used to receive visiting dignitaries or support missions for operations occurring at PAFB. Records show that annual utilization of the airfield fluctuates proportionately with launch activity on CCAS. The Skid Strip does not generate a large amount of air traffic, is located on an isolated peninsula, and does not impact civilian areas. (CCAS 1991, CCAS 1992)

SMAB at CCAS

The most suitable CCAS facility for X-33 spaceplane processing is the SMAB in the Titan Integrate Transfer Launch (ITL) area. By 1998, the SMAB will no longer be in use for stacking Titan IV solid rocket motors (although the associated Spacecraft Integration Facility (SPIF) payload processing facility will still be needed to support Titan IV and possibly evolved expendable launch vehicle (EELV) payloads). Some modifications will be required to accommodate the X-33 spaceplane, and exact requirements will be identified when the detailed design is known. The SMAB has an existing explosive safety/quantity distance (ES/QD) which would accommodate any projected propellant quantities for X-33 activities. ES/QD's are exclusion distances between facilities based on maximum explosive potential of stored propellants or other materials categorized as explosive. An exception to this assumption would be full dual-propellant fueling of the spaceplane, an activity currently contemplated to occur on the launch pad. (SFA 1995)

LC-39 at KSC

KSC LC-39 has two launch pads, A and B, which were originally designed to support the Apollo Program and were modified for Space Shuttle launch operations. Major changes included erection of a new Fixed Service Structure (FSS), addition of a Rotating Service Structure (RSS), and replacement of Saturn flame deflectors with three new flame deflectors. Fuel, oxidizer, high pressure gas, electrical, and pneumatic lines connect the Shuttle vehicle with GSE and are routed through the RSS, FSS, and Mobile Launch Platform (MLP). The RSS accommodates loading payloads vertically at the pad. It rotates on a semi-circular track through an arc of 120 degrees on a radius of 37 m (120 ft). Blast-protected hypergolic storage and supply systems are provided at each pad, and the Launch Processing System (LPS) is used to monitor all aspects of vehicle and payload operations. The FSS is topped by a 24 m (80 ft) tall fiberglass lightning mast grounded by 335 m (1,100 ft) cables anchored north and south of the pad. The mast provides lightning protection for pad structures and the Space Shuttle. Pads 39A and B are virtually identical and roughly octagonal in shape. The distance between pads is 2,657 m (8,715 ft). Each pad has an 18 m wide by 137 m long by 13 m deep (58 ft by 450 ft by 42 ft) flame trench. The Orbiter flame deflector is 12 m (38 ft) high, 22 m (72 ft) long, and 18 m (58 ft) wide and weighs 590,000 kg (1.3 million lb). The SRB deflector is 13 m (43 ft) high, 13 m (42 ft) long, and 17 m (57 ft) wide and weighs 499,000 kg (1.1 million lb). The Sound Suppression Water System is used to protect the launch structure from the intense sound pressure of liftoff. Its water tank is 89 m (290 ft) high and has a capacity of 1,135,000 L (300,000 gal). The pads also contain large LH_2 and LOX storage tanks. LOX tanks store 3,407,000 L (900,000 gal) at a temperature of -183 degrees C (-298 degrees F). LH_2 tanks store 3,220,000 L (850,000 gal) at a temperature of -253 degrees C (-423 degrees F). The Weather Protection System protects Orbiter tiles from windblown debris, rain, and hail. (KSC 1992, SFA 1995, KSC 1996-A)

SLF at KSC

The SLF is a concrete facility located approximately 3 km (2 mi) northwest of the VAB on a northwest to southeast (Runway 15) or southeast to northwest (Runway 33) alignment, with the launch pads only 5 to 6 km (3 to 4 mi) to the east. It is approximately 4,600 m (15,000 ft) long, 91 m (300 ft) wide, and 41 cm (16 in) thick at the center, with a 305 m (1,000 ft) paved safety overrun at each end. The SLF also has 15 m (50 ft) wide paved shoulders on each side. An array of visual aids as well as sophisticated guidance equipment at the SLF help guide the Orbiter to a safe landing. The Tactical Air Navigation (TACAN) system on the ground provides range and bearing measurements to the vehicle at an altitude of up to 44,200 m (145,000 ft). More precise guidance signals on slant range, azimuth, and elevation come from four sophisticated Microwave Scanning Beam Landing System (MSBLS) stations when the vehicle gets closer—5,500 to 6,100 m (18,000 to 20,000 ft). Visual aids are also provided by the Precision Approach Path Indicator (PAPI) system. A 168 by 146 m (550 by 480 ft) aircraft parking apron, or ramp, is located at the southeastern end of the runway. On the northeast corner of the ramp is the MDD which acts as a lift during ferry operations. Adjacent to the MDD is the Landing Aids Control Building, which houses equipment and personnel who operate the SLF on a daily basis. At the midfield point is the convoy staging area for the recovery team, control tower, fire station, and viewing area for press and guests. (KSC 1992, SFA 1995, KSC 1996-A)

VAB at KSC

The VAB was originally built for assembly of Apollo/Saturn vehicles and later modified to support Space Shuttle operations. High Bays 1 and 3 are used for integration and stacking of the complete Space Shuttle vehicle. High Bay 2 is used for ET checkout and storage and as a contingency storage area for Orbiters. High Bay 4 is also used for ET checkout and storage, as well as payload canister operations and SRB contingency handling. The Low Bay area contains Space Shuttle main engine maintenance and overhaul shops, and serves as a holding area for SRB forward assemblies and aft skirts. The VAB covers 3.3 ha (8 ac) and is 160 m (525 ft) tall, 218 m (716 ft) long, and 158 m (518 ft) wide. It encloses 3.7 million cubic m (129.4 million cubic ft) of space. The VAB has 71 cranes, including two 227 metric ton (250 ton) bridge cranes. The four high bay doors are 139 m (456 ft) high. The north entry to the transfer aisle was widened 12 m (40 ft) to permit entry of the Orbiter, and slotted at the center to accommodate its vertical stabilizer. The VAB can accommodate the X-33 spaceplane without any modifications to the building structure. (KSC 1992, SFA 1995, KSC 1996-A)

2.3.4 Generic Alternatives

2.3.4.1 Secondary Landing Sites

Secondary landing sites (i.e., landing sites remote from EAFB, WSMR, or the ER) are under consideration, but no determination of alternatives has been made. Designation of exact secondary landing sites and respective test flight corridors was not a requirement of CAN-1. Therefore, a number of alternative secondary landing sites could not be identified. The need and proposed geographical locations will be based on the ultimately proposed flight test expansion requirements and nonfeasibility or impracticality of landing on one of the proposed primary sites. Requirements for alternate landing sites include, but are not limited to: Government-controlled (or possibly privately controlled, but non-commercial airport) facilities; existing infrastructure such as a hard surfaced landing strip meeting the minimum requirements for safe landing of a horizontal landing spaceplane or available land for landing of a vertical landing spaceplane with necessary fire protection clear zones; non-interference with existing programs; and environmental acceptability for mitigating noise and risk impacts to the public and private property.

A generic profile of potential relevant environmental issues associated with landing at an alternate site is presented in this EA. Further comprehensive environmental analyses will be provided on alternatives under consideration following the decision and preferences in the Phase II Cooperative Agreement. The decision on final selection of alternate site(s) will be made by NASA following conclusion of the second X-33 environmental document, which will be referred to as EA-II in the reminder of this document, if there is a decision to continue the program. NASA will proceed with preparation of EA-II; however, if impact determinations cannot be supported with a Finding of No Significant Impact (FONSI), an Environmental Impact Statement (EIS) will ultimately be issued. With either document, EA or EIS, NASA intends to conduct public scoping meetings and issue the second EA or EIS in both draft and final form for public comment.

2.3.4.2 Test Flight Corridors

Test flight corridors with defined trajectories or paths between the primary site and landing site(s) will also be described in comprehensive detail in the X-33 EA-II. The major environmental issues of noise and safety (risk) are provided in this EA in a generic context. Proposed alternative flight corridors will be environmentally evaluated in the X-33 EA-II which NASA will use to make final flight test decisions.

2.3.4.3 Return to Primary Site Alternatives

Several alternatives are under early consideration for returning the X-33 spaceplane from a remote landing site. These alternatives include:

- Fly back on the Space Shuttle carrier aircraft currently used to return Space Shuttles from landings at EAFB to the launch site at KSC
- Rail
- Barge (ER alternative)
- Surface roads provided size and weight are acceptable
- Reflight using minimal takeoff support capability at the alternate site

Proposed alternative "return to primary site" transportation alternatives will be environmentally evaluated in the X-33 EA-II which NASA will use to make final flight test decisions.

2.3.5 No Action Alternative

The No Action Alternative for the X-33 Program is to not design, fabricate, and flight test the X-33 spaceplane, and consequently, to not demonstrate the potential ability to significantly reduce the cost of development, production and operation of future, new reusable spaceplane systems which could be commercially implemented. By implementing the No Action Alternative, the RLV Program could not proceed, resulting in continued reliance on existing Government-owned or controlled space launch vehicles such as the Space Shuttle, capable of carrying payloads, cargo, and humans, with its reusable Orbiter and boosters and expendable external (LOX/LH_2) tank, and expendable launch vehicles such as the Titan IV, Delta, and others, capable of carrying only payloads and cargo. These existing launch vehicles have been the subject of previous environmental documentation which will be used for environmental comparative purposes with no further assessment. (NASA 1978, GSFC/WFF 1994, DOT 1986, DOT 1992, CCAS 1986, CCAS/VAFB 1990, VAFB 1991, CCAS 1991, USAF 1994)

2.3.6 Alternatives Considered But Not Carried Forward

2.3.6.1 Primary Sites

During Phase I, two additional primary sites for operations and flight tests were considered: Vandenberg Air Force Base (VAFB), California, and Wallops Flight Facility (WFF), Virginia. Although assets and facilities at both sites were considerable, with VAFB containing more than WFF, there were overriding advantages at EAFB, WSMR, and the ER. However, selection of the primary site for the X-33 Program has no necessary correlation with the primary site for a commercial RLV Program, if one is undertaken.

2.3.6.2 Propulsion Systems

Initially, tripropellant engine technology using a combination of LH_2 and RP-1 (a highly refined petroleum product classified in the kerosene family) as the fuel source and LOX as the oxidizer was considered as an alternative propulsion system for use on the X-33 spaceplane. All tripropellant engine technology is Russian, and sufficient data are not available in the U.S. to determine risk, reliability, and life cycle costs.

3.0 Affected Environments

3.1 Primary Sites

3.1.1 EAFB/ AFFTC/DFRC

This section discusses the affected environment for takeoff and landing sites on EAFB described in Section 2.3.3.1.

3.1.1.1 Facilities and Infrastructure

Wastewater Treatment

Three separate systems collect and treat wastewater on the base, with each system designed to serve a specific area. The Main Base wastewater treatment plant (WWTP) serves both Main Base and South Base. The WWTP provides primary treatment, disposing of the effluent through evaporation ponds. The second and third WWTP's are located at North Base and PL. Both facilities are considerably smaller than the Main Base WWTP, both use an inground Imhoff tank, and both discharge directly to evaporation ponds. DFRC wastewater drains through a network of sanitary sewer lines to the EAFB WWTP. A tertiary treatment plant began operations in 1996; Main Base, North Base, and DFRC are connected to it. (EAFB 1994-A, DFRC 1996)

Electricity

EAFB receives electricity from Southern California Edison and the Western Area Power Administration (WAPA). A 115-kilovolt (kV) line enters the North Base where it serves two 115/34-kV substations. The substations in turn supply electrical service to the North Base, Main Base, and PL. The 115-kV transmission line continues from substations to the South Base, where it feeds a 25-megavolt-ampere (MVA), 115/34-kV substation. Electric power is received at 34.5 kV, and most of the electrical facilities are overhead. Exceptions are the main housing area and all lines along Wolfe Avenue and the flight line area. DFRC is connected to this electrical system and all lines there are underground. Several emergency power generators are available to provide backup power. (EAFB 1994-A, DFRC 1996)

Communications

The Command, Control, Communications, and Computer Systems (C4) provides EAFB electronic support. The AFFTC Telecommunications Facility and Distribution System provides telephone services, voice mail, Defense Switch Network (DSN), and Federal Telephone Service (FTS 2000). The system is connected with an 80.5 km (50 mi), 48-strand, single-mode fiberoptic loop. All AFFTC core facilities, North Base, South Base, and PL are connected to the fiberoptic ring. Only 4 of the 48 strands are required to support the telephone system, leaving 44 strands available for computer networking and future growth. The land mobile radio system is a trunked system. A state-of-the-art computer-controlled ultrahigh frequency (UHF) network allowing over-the-air net customizing enables users to change who they are talking to and who can listen to their transmission. In addition, the system is Digital Encryption Standard (DES) compatible. The Air Traffic Control and Landing System (ATCALS) and meteorological systems provide users with ground-based flight navigational systems, which receive and transmit safety of flight information to air and ground-to-ground radio equipment. The systems currently operating include: AN/FRN 45 Very High Frequency (VHF) Omni Range/Tactical Air Navigational (VOR/TAC), AN/GRN-29 Instrument Landing System (ILS), ML-658 Digital Barometer (DBASI), FMQ-8 Temp Dewpoint, FMQ-13 Digital Winds, GMQ-34 Laser Beam Ceilometer, TQM-36 Tactical Winds, GMQ-20 Wind/Speed/ Direction, Rivet Switch receiver and transmitter, and the Next Generation Radar (NEXRAD) Weather System.

Natural Gas

Pacific Gas and Electric provides natural gas from two 91 cm (36 in) diameter transmission lines paralleling State Highway 58 north of the base. A 15 cm (6 in) pipeline branches off into the base and provides gas at 1,030 kPa (150 psi). Feeder lines provide gas to the Main Base, North Base, South Base, DFRC, and the core area of PL. (EAFB 1994-A, DFRC 1996)

Fuel

Jet fuels (JP-4, JP-5, JP-7, JP-8, and JP-10) as well as diesel fuel, regular leaded and unleaded gasoline, and fuel oil are stored at EAFB and managed by the Fuels Management Branch. Petroleum products are stored in 13 aboveground storage tanks (AST's) and 12 underground storage tanks (UST's). Fuel storage capacities include approximately 9.2 million L (2.4 million gal) of JP-8 (the primary jet fuel at EAFB); 3.8 million L (1.0 million gal) of JP-7; 454,000 L (120,000 gal) of JP-5; 1.2 million L (325,000 gal) of diesel; 3.4 million L (900,000 gal) of gasoline; and 950,000 L (250,000 gal) of fuel oil.

The array of fuels requires several separate distribution systems. JP-8 is delivered by a 15 cm (6 in) pipeline to the main tank farm into either a 3.2 million L (840,000 gal) or a 1.5 million L (400,000 gal) tank. The pipeline is maintained and operated by the California-Nevada Pipeline Company. From the storage area, fuel is gravity fed to the Hydrant 1 system, which contains four 190,000 L (50,000 gal) UST's; or to the Hydrant 3 system, which contains two internal floating roof tanks with a 1.5 million L (400,000 gal) capacity. Aircraft fueling occurs via both hydrant and refueling trucks.

Other fuels are delivered via refueling truck. In the South Base area, JP-8 is stored in two 190,000 L (50,000 gal) UST's at Facility 1873, three 57,000 L (15,000 gal) and three 95,000 L (25,000 gal) AST's at Facility 4511, and two 400,000 L (105,000 gal) tanks in the general vicinity. Petroleum products are also stored at the flightline service station in three 95,000 L (25,000 gal) tanks and at the military service station. (EAFB 1994-A)

EAFB has the facilities to store 45,400 L (12,000 gal) of LH_2, and pump and dispose of LH_2 through controlled "evaporation" at test area 1-52C. Test stand 1A at area 1-120 is being modified for testing EELV engines. A 341,000 L (90,000 gal) LH2 tank and a 284,000 L (75,000 gal) LOX tank, along with associated piping and flare stacks, are being readied for initial test in September 1995. Tank for LOX and LH_2 required to fuel the X-33 spaceplane will be placed adjacent to the selected takeoff site.

Hazardous Waste

EAFB is operating in an interim status as a large quantity generator of hazardous waste pending the U.S. Environmental Protection Agency's (EPA's) processing of its renewal application. In 1992, approximately 10,300 kg (22,600 lb) per month of hazardous waste were generated. EAFB has drum storage capacity for 153,000 L (40,500 gal) of hazardous waste. It currently operates at an average of 50 percent capacity.

A hazardous waste management plan has been prepared and implemented to ensure compliance with Resource Conservation and Recovery Act (RCRA) requirements. The plan establishes specific policies, responsibilities, and procedures for hazardous waste management operations, including petroleum products and polychlorinated biphenyls (PCB's). Personnel who manage or handle hazardous waste must receive annual safety and documentation protocol training, in addition to annual RCRA and Occupational Safety and Health Administration (OSHA) Hazard Communication training. (EAFB 1994-A)

Hazardous waste is stored at various satellite accumulation areas near the points of generation, where up to 210 L (55 gal) of hazardous waste or 1.0 L (1 qt) of an acute hazardous waste can be stored up to 1 year. Waste is then transferred to designated accumulation points or treatment, storage, and disposal facilities for offsite recycling or disposal by permitted contractors. (EAFB 1994-A)

Solid Waste

Solid waste generated on EAFB is disposed of in the Main Base landfill located approximately 2.1 km (1.3 mi) north of the family housing area. The permitted Class III landfill accepts nonliquid, nonhazardous wastes including residential, construction/demolition, commercial, and industrial wastes. Principal areas contributing solid waste to the facility are the Main Base, South Base, North Base, and PL. The landfill is owned and operated by the USAF and is not open to the public. DFRC currently ships solid waste offsite, but arrangements are being made to use the EAFB landfill. Recycling and salvaging operations are managed by the EAFB Environmental Management Group. Recycled materials include newspapers, magazines, shredded high-grade white paper, high density polyethylene (HDPE) plastic, clear and colored glass, and ferrous and nonferrous metals. On-base waste collection is accomplished by private contractors. (EAFB 1994-A, DFRC 1996)

3.1.1.2 Air Quality

EAFB is located in the northwest portion of the Southeast Desert Air Basin (SEDAB). The SEDAB consists of the desert part of San Bernardino and Riverside counties, the eastern parts of Kern and Los Angeles counties, and all of Imperial County. Most of the base lies in Kern County, with small portions in Los Angeles and San Bernardino counties. The desert portions of Los Angeles and San Bernardino counties are classified by EPA as nonattainment for ozone (O_3), while the desert area for Kern County is unclassified. The attainment designation for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulates (PM_{10}) in the desert area of all three counties is unclassified. All three counties are classified by the California Air Resources Board as nonattainment for O_3 and PM_{10}. Los Angeles and San Bernardino counties are classified by the Board as attainment for CO, NO_2, and SO_2. Kern County is classified by the Board as attainment for CO and SO_2. (EAFB 1994-A)

The closest and most representative air quality monitoring station is located in Lancaster, about 3.2 km (2.0 mi) southwest of EAFB. O_3 and PM_{10} concentrations exceeded both state and federal ambient standards from 1989 through 1991.

Pollution emissions inventories were prepared in 1992 for EAFB and the Kern County portion of the SEDAB. The emission inventory, prepared by the Kern County Air Pollution Control District (APCD), includes only emissions from stationary sources. Emissions from mobile sources, such as motor vehicles and aircraft, were not calculated. EAFB contributes approximately 43 percent of the hydrocarbon burden to the Kern County portion of the SEDAB and 2 percent or less to the burden of the other criteria pollutants (CO, No_x, So_x, and PM). (EAFB 1994-A)

In 1987, the California Legislature enacted Assembly Bill 2588 establishing a process for inventorying selected toxic substances, determining health risks, and notifying the public regarding these risks. The EAFB 1992 emission inventory identified 82 air toxic compounds listed by the California Air Resources Board. The total emission rate of these compounds was 77.58 tons per year. Of the 82 compounds, 24 are considered carcinogenic. The total emission rate of the carcinogenic compounds is about 7 tons per year. (EAFB 1994-A)

Transport of air pollutants to EAFB occurs from the South Coast Air Basin through Soledad Canyon, the San Joaquin Valley Air Basin, the San Francisco Bay Area, and the Tehachapi Mountain Pass. It is possible that increased growth in the southern portion of the San Joaquin Valley may affect the air quality in the western Mojave Desert. (EAFB 1994-A)

3.1.1.3 Airspace

The Edwards Control Tower separates and sequences aircraft in the airspace immediately surrounding the airport installation. Service includes aircraft on either IFR or VFR clearances.

Radar-monitored air traffic control is provided by Air Route Traffic Control Centers (ARTCC's). Los Angeles Center located at Palmdale, California (one of the busiest in the United States), provides control of civil and military IFR air traffic and some service to VFR air traffic, which transits the airspace on three sides of the R-2508 Complex. Oakland Center manages the airspace north of the Complex.

The R-2508 Complex is a tri-service test complex used by DOD for test and evaluation of piloted and remotely piloted aerospace vehicles and weapon system technologies. R-2508 occupies over 32,000 sq km (20,000 sq mi) in an area approximately 274 km (170 mi) long north to south and ranging in width from approximately 111 to 163 km (69 to 142 mi). The Complex is managed by the three principal military activities in the region: AFFTC, EAFB; Naval Air Warfare Center (NAWC), China Lake; and National Training Center (NTC), Fort Irwin. R-2508 contains seven Restricted Areas depicted in Figure 3.1-1.

One-fourth (25 percent) of all air traffic control activities for the Los Angeles Center occurs in the nine sectors containing or surrounding the R-2508 Complex. Based on historical data, the Federal Aviation Administration (FAA) forecasts an average annual growth in aircraft operations between 4.5 and 6.0 percent. Aircraft operations during 1996 should be approximately 60,000 per month.

3.1.1.4 Biological Resources

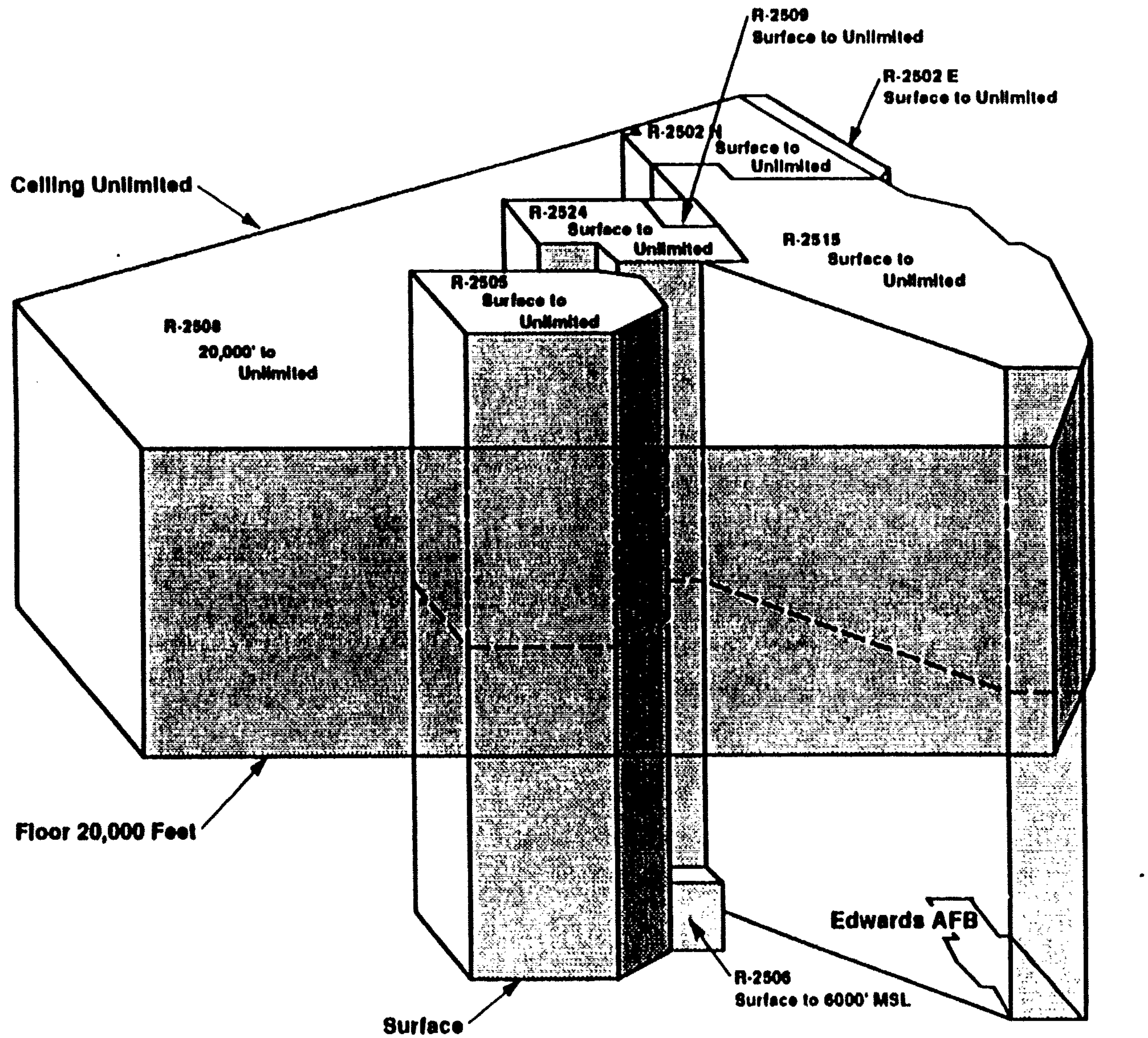
Biological resources include native and introduced plants and animals and their respective habitats. The two regions of influence are site areas where ground disturbance or operations may affect biological resources and the overflight area.

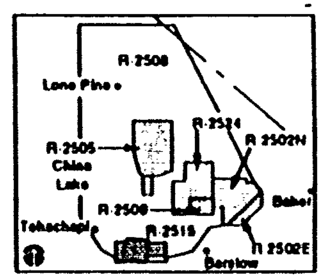
The region of influence for ground support includes: the South Base Site, Spaceport 2000 Site 1, Spaceport 2000 Site 2, and the NASA-North Base Site. Use of other overlay facilities is not expected to affect biological resources, except by reducing the amount (0.2 to 2.4 ha (0.5 to 6.0 ac)) of ground disturbance at the proposed site in South Base. For discussion purposes, each area is divided into vegetation, wildlife, and sensitive habitats.

Overflight areas are considered with respect to potential noise impacts on biological resources; consequently, only wildlife (including threatened or endangered wildlife) and domestic animals are considered. The affected area for overflight is limited to the R-2508 Complex area.

<u>Vegetation</u>

South Base Site, Spaceport 2000 Sites 1 and 2: Vegetation is a halophytic phase of saltbush scrub dominated by a variety of low shrubs. The most common are Mojave saltbush or spinescale (*Atriplex spinifera*) and allscale (*Atriplex polycarpa*). Plant communities on EAFB are shown in Figure 3.1-2. Also prevalent are Anderson desert thorn or wolfberry (*Lycium andersonii*), Nevada tea (*Ephedra nevadensis*), spiny hopsage (*Grayia spinosa*), and patches of peach-thorn (*Lycium cooperi*), Cooper's goldenbush (*Haplopappus coperi*), Alkali goldenbush (*H. acradenius*), matchweed (*Gutierrezia microcephala*), rabbitbrush (*Chrysothamnus* sp.), and occasional great basin sagebrush (*Artemisia tridentata*). A few tamarisks (*Tamarix* cf. *pentandra*) and relatively large mesquites are present. Vegetated areas grade rather abruptly into the unvegetated playa of





Source: AFFTC regulation 55-2, vol. I

Figure 3.1-1. R-2508 Complex Restricted Areas